REMARKS

The present application includes claims 1-62. Claims 54-62 have been allowed. Claims 1-53 were rejected by the January 28, 2004 Office Action.

Claims 1, 7-8, 18, 41, 43 and 51 are amended in response to Examiner's rejections. Claim 23 is canceled. Claims 19-20 are amended to correct antecedent basis. Claim 24 is amended to correct claim dependency due to the cancellation of claim 23.

Claims 1, 7-8, 43 and 51 are amended to recite the limitation of a first active transducer layer including a first pair of composite layers and a second active transducer layer including a second pair of composite layers.

Claim 7 is also amended to recite the limitations of M_1 defining frequency dependent matching circuitry elements, γ_1 defining the passive circuitry including at least one of an inductor, a capacitor and a resistor, $D_1(f)$ defining electronic tuning circuitry responses, $T_1(f)$ defining a transmit transfer function and f defining a frequency.

Claim 8 is also amended to recite the limitations of G_1 defining an overall receive transfer function and at least one of γ_1 and g_1 including passive circuitry, where the passive circuitry includes at least one of an inductor, a capacitor, a resistor and a probe cable.

Claim 18 is amended to recite the limitation of a first active transducer layer of a first transducer element connected to a circuit having different properties than a circuit connected to a first active transducer layer of a second transducer element.

Claim 41 is amended to recite the limitation of a first and second transducer elements of the N transducer elements each including first and second active layers, where a frequency response of first and second active layers of the first transducer element is equivalent to a frequency response of first and second active layers of the second transducer element and where the second transducer element is symmetrically positioned relative to the first transducer element.

Claims 1-18, 21-39 and 43-53 were rejected under 35 U.S.C. § 102(b) as being anticipated by the Mine et al. (U.S. Patent No. 5,724,976).

Claims 1-53 were rejected under 35 U.S.C. § 102(e) as being anticipated by Hossack (U.S. Patent No. 6,409,667) alone or together with Wright et al. (U.S. Patent No. 5,685,308), as essential incorporation-by-reference therein.

Claims 7-8 were rejected under 35 U.S.C. § 112, ¶ 2 as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as the invention.

The Applicant first turns to the rejection of claims 1-18, 21-39 and 43-53 under 35 U.S.C. § 102(b) as being anticipated by Mine. Mine discloses ultrasound imaging preferable to ultrasound contrast echography. Specifically, Mine describes a transducer element consisting only of two transducer layers (col. 7, lines 41-51; FIGS. 1A, 3, 4A-D,

6-10). The two transducer layers of Mine are connected to three electrodes (col. 7, lines 41-51).

Mine does not teach a first active transducer layer connected to a first receiver and a first transmitter and a second active transducer layer laminated to the first active transducer layer and connected to a second receiver and a second transmitter, where the first active transducer layer includes a first pair of composite layers and the second active transducer layer includes a second pair of composite layers, as recited in claims 1, 7-8, 43 and 51. Conversely, as described above, Mine merely describes a transducer unit consisting of two transducer layers connected to three electrodes (col. 7, lines 41-51). Thus, the Applicant respectfully submits that Mine does not teach elements of the claimed invention.

Mine also discloses a low-pass filter circuit interposed between a preamplifier circuit and a reception delay circuit (col. 11, lines 66-67; col. 12, lines 1-9; col. 14, lines 31-36; filter 60 in FIGS. 6, 10). The filer disclosed in Mine is part of the receiving system of the transducer unit (col. 11, lines 66-67; col. 12, lines 1-9). In this way, Mine merely discloses a filter that filters an output prior to display. Similarly, as stated by the Examiner in the January 28, 2004 Office Action, "[f]iltering 60 in Mine et al is performed after pre-amplification 45 and prior to final amplification for display . . . . The filtered outputs in both references pass through passive circuit components and are

summatively combined (focusing) prior to coding for video display" (Jan. 28, 2004 Office Action, page 3).

Conversely, Mine does not teach passive circuitry where a first pulse produced by the first transmitter and a second pulse produced by the second transmitter are processed by the passive circuitry prior to being combined into a single ultrasound pulse, as recited in claim 16. As described above, Mine merely describes the processing of received and not transmitted pulses (col. 11, lines 66-67; col. 12, lines 1-9). In this way, as the filter of Mine is included in receiving circuitry, Mine is incapable of describing the processing of first and second transmitted pulses prior to being combined into a single ultrasound pulse. Thus, the Applicant respectfully submits that Mine does not teach elements of the claimed invention.

Mine also discloses an ultrasound system including a piezoelectric member segmented into several transducers (col. 6, lines 60-64; transducers 25_1 to 25_n of FIG. 1). Each transducer 25_n of Mine is attached to an electrode 27_n (col. 6, lines 64-67; col. 7, lines 1-5). Each electrode 27_n is then connected to a receiving system of Mine (col. 8, lines 48-51; col. 9, lines 34-43; FIG. 1). In this way, each transducer **element** is connected to a receiver.

Conversely, Mine does not teach a first active transducer layer connected to a first receiver and a first transmitter and a second active transducer layer laminated to the first active transducer layer and connected to a second receiver and a second transmitter, as

recited in claims 16 and 17. Similarly, Mine does not teach a first active transducer layer connected to a first receiver and a second active transducer layer laminated to the first active transducer layer and connected to a second receiver, as recited in claim 18. Also, Mine does not teach providing a transducer element comprising a first active transducer layer connected to a first receiver and a second active transducer layer connected to a second receiver, as recited in claim 44. Conversely, as described above, Mine merely discloses the connection of an **entire transducer element** to a receiving system (FIG. 1), as opposed to a first active transducer layer and a second active transducer layer connected to first and second receivers, respectively. In this way, as Mine describes an entire transducer unit connected to a receiving system, Mine is incapable of teaching a first active transducer layer connected to a first receiver and a second active transducer layer connected to a second receiver. Thus, the Applicant respectfully submits that Mine does not teach elements of the claimed invention.

Mine also describes an ultrasound system including several transducer elements, where each element consists of two layers (FIG. 10). Each transducer element is connected to three electrodes (col. 6, lines 64-68; col. 7, lines 1-5; electrodes 26_n, 27_n and 28_n of FIG. 10). The three electrodes connect each transducer element to a "system 1" and "system 2," where "system 1" is connected to circuits 40-42 of a transmitting system and circuits 52-56 of a receiving system (col. 8, lines 44-51; col. 14, lines 27-31; FIG. 10). Similarly, "system 2" is connected to a transmitting system including elements 70-

72 and to a receiving system including circuits 45, 60 and 47-50 (col. 14, lines 31-36; FIG. 10). In this way, every single transducer element of Mine is connected to an identical "system 1" transmitting system, an identical "system 1" receiving system, an identical "system 2" transmitting system and an identical "system 2" receiving system (col. 6, lines 64-68; col. 7, lines 1-5; col. 8, lines 44-51; col. 14, lines 27-31; col. 14, lines 31-36; FIG. 10).

Conversely, Mine does not teach a first active transducer layer of a first transducer element connected to a circuit having different properties than a circuit connected to a first active transducer layer of a second transducer element, as recited in claim 18. Instead, as described above, Mine describes several transducer elements connected to identical transmitting and receiving systems (col. 6, lines 64-68; col. 7, lines 1-5; col. 8, lines 44-51; col. 14, lines 27-31; col. 14, lines 31-36; FIG. 10). As Mine discloses identical systems connected to every single transducer element, Mine is incapable of teaching a first active transducer layer of a first transducer element connected to a circuit with different properties than a circuit connected to a first active transducer layer of a second transducer element. Thus, the Applicant respectfully submits that Mine fails to teach an element of the claimed invention.

The present rejection encompasses claims 1-18, 21-39 and 43-53. As described above, the Applicant respectfully submits that Mine fails to teach elements of independent claims 1, 7-8, 16-18, 43-44 and 51. Claims 2-6, 9-15, 21-39, 45-50 and 52-

53 depend from claims 1, 7-8, 16-18, 43-44 and 51. Consequently, the Applicant respectfully submits that the present claims should be allowable.

The Applicant next turns to the rejection of claims 1-53 under 35 U.S.C.§ 102(e) as being anticipated by Hossack alone or together with Wright as an essential incorporation-by-reference therein. Hossack describes a medical diagnostic ultrasound transducer system and method for harmonic imaging. Specifically, Hossack discloses a transducer system that includes a transducer element connected with a transmitter and a receiver (col. 2, lines 46-52; FIG. 1). The transducer element consists of a top layer and a bottom layer (col. 2, lines 53-57; FIG. 1).

However, Hossack does not teach a transducer element comprising a first active transducer layer that includes a first pair of composite layers and a second active transducer layer that includes a second pair of composite layers, as recited in claims 1, 7, 8, 43 and 51. Conversely, as described above, Hossack merely describes a transducer element with two layers (col. 2, lines 53-57; FIG. 1). Thus, the Applicant respectfully submits that Hossack does not teach elements of the claimed invention.

Wright describes a method and apparatus for a receive beamformer system. Specifically, Wright discloses a plurality of fully programmable multi-channel receivers for use in an ultrasound imaging system (Abstract; col. 4, lines 38-43). Specifically, Wright describes a substantially digital signal processing architecture of independent

receivers (col. 4, lines 44-46) and an architecture having a unique arrangement and implementation of digital signal processing and beamforming (col. 5, lines 10-14).

However, Wright does not teach a transducer element comprising a first active transducer layer that includes a first pair of composite layers and a second active transducer layer that includes a second pair of composite layers, as recited in claims 1, 7, 8, 43 and 51. Conversely, Wright does not disclose any type or sort of transducer element structure at all (see FIGS. 1a through 11). Therefore, as Wright does not teach any transducer structure at all, Wright is then incapable of teaching a transducer element comprising a first active transducer layer that includes a first pair of composite layers and a second active transducer layer that includes a second pair of composite layers. Thus, the Applicant respectfully submits that Wright also fails to teach elements of the claimed invention.

Wright also discloses a digital multi-channel receive processor R-101 that includes a filter/delay unit R-122 (col. 12, lines 60-67; col. 13, lines 1-2; FIG. 2b). The signals from individual transducer elements T-114 are received and communicated to a receive multiplexer R-108 (col. 12, lines 47-51; FIG. 2b). Through the receive multiplexer R-108, each transducer element T-114 is connected to a digital multi-channel receiver R-101 (col. 12, lines 47-59; FIG. 2b). As described above, each multi-channel receiver R-101 includes a filter/delay unit R-122 (col. 12, lines 60-67; col. 13, lines 1-2;

FIG. 2b). In this way, Wright merely describes the filtering of **received, not transmitted** transducer signals.

Conversely, Wright does not teach passive circuitry where a first pulse produced by a first transmitter and a second pulse produced by a second transmitter are processed by the passive circuitry prior to being combined into a single ultrasound pulse, as recited in claim 16. Instead, as described above, Wright merely describes the filtering of **received** signals from a transducer element (col. 12, lines 60-67; col. 13, lines 1-13; FIG. 2b). Thus, the Applicant respectfully submits that Wright fails to teach elements of the claimed invention.

Hossack discloses a receive beamformer 32 that receives summed information from the top 12 and bottom layer 14 of the transducer element 10 (col. 4, lines 24-59; FIG. 1). The receive beamformer 32 includes a filter 34 (col. 4, lines 50-59; FIG. 1). The filter 34 **receives** beamformed data from the receive beamformer 32 (col. 4, lines 60-67; FIG. 1). Therefore, the filter of Hossack does not act on any signal or information from a transducer element until the signal or information is first received.

Consequently, Hossack also does not teach passive circuitry where a first pulse produced by a first transmitter and a second pulse produced by a second transmitter are processed by the passive circuitry prior to being combined into a single ultrasound pulse, as recited in claim 16. Instead, as described above, Hossack, like Wright, merely describes the filtering of **received** signals or information, and does not teach the

processing of any transmitted pulses (col. 4, lines 24-65; FIG. 1). Thus, the Applicant respectfully submits that Hossack also fails to teach elements of the claimed invention.

As described above, Wright discloses a digital multi-channel receive processor R-101 that includes a filter/delay unit R-122 (col. 12, lines 60-67; col. 13, lines 1-2; FIG. 2b). The signals from individual transducer elements T-114 are received and communicated to a receive multiplexer R-108 (col. 12, lines 47-51; FIG. 2b). Through the receive multiplexer R-108, each transducer **element** T-114 is connected to a digital multi-channel receiver R-101 (col. 12, lines 47-59; FIG. 2b). As described above, each multi-channel receiver R-101 includes a filter/delay unit R-122 (col. 12, lines 60-67; col. 13, lines 1-2; FIG. 2b). In this way, Wright merely describes the connection of an entire transducer element to a receiver.

Similarly, as described above, Hossack discloses a receiver 22 connected to both layers 12, 14 of a transducer element 10 (col. 3, lines 40-59; FIG. 1). In this way, Hossack merely describes the connection of an entire transducer **element** to a single receiver.

Conversely, neither Wright nor Hossack teach a first active transducer layer connected to a first receiver and a first transmitter and a second active transducer layer laminated to the first active transducer layer and connected to a second receiver and a second transmitter, as recited in claims 16 and 17. Similarly, neither Wright nor Hossack teach a first active transducer layer connected to a first receiver and a second active

transducer layer laminated to the first active transducer layer and connected to a second receiver, as recited in claim 18. Also, neither Wright nor Hossack teach providing a transducer element comprising a first active transducer layer connected to a first receiver and a second active transducer layer connected to a second receiver, as recited in claim 44. Instead, as described above, Wright merely discloses the connection of an **entire transducer element** to a receiving system (col. 12, lines 45-67; col. 13, lines 1-13; FIG. 2b), as opposed to a first active transducer layer and a second active transducer layer connected to first and second receivers, respectively. Similarly, Hossack merely describes the connection of two layers of a transducer element to a single receiver (col. 3, lines 41-59; FIG. 1). In this way, both Wright and/or Hossack are incapable of teaching a first active transducer layer connected to a first receiver and a second active transducer layer connected to a second receiver. Thus, the Applicant respectfully submits that neither Wright nor Hossack teach elements of the claimed invention.

Wright also describes an apodization processor included in a secondary or local processor control for the digital multi-channel receiver (FIGS. 3, 8; col. 25, lines 41-49). The apodization processor obtains a sparse table of range bounded apodization values from a focus processor of a central control (FIG. 8; col. 29, lines 1-4). The apodization processor of Wright also may internally calculate interpolation/extrapolation range coefficients based on scan geometry parameters supplied from a central control (col. 29, lines 24-28).

However, Wright does not teach a linear transducer array comprising N transducer elements, where active transducer layers are arranged to obtain frequency variable apodization across the array during transmission, as recited in claim 41. Conversely, Wright merely describes an **apodization processor** that generates apodization values or interpolation/extrapolation range coefficients for each output sample of each transducer beam (col. 29, lines 1-45). However, while Wright may describe an apodization processor that generates values to fill in a sparse data set, Wright in no way teaches the arrangement of active transducer layers to obtain frequency variable apodization across the array, as recited in claim 41. That is, Wright does not describe **any arrangement of any active transducer layers** to obtain frequency variable apodization.

Furthermore, Wright does not teach first and second transducer elements of the N transducer elements each including first and second active layers, where a frequency response of first and second active layers of the first transducer element is equivalent to a frequency response of first and second active layers of the second transducer element and where the second transducer element is symmetrically positioned relative to the first transducer element, also as recited in claim 41. Conversely, as stated directly above, Wright does not teach **any arrangement** of active transducer layers whatsoever, whether to obtain frequency variable apodization or otherwise. Therefore, as Wright does not teach any arrangement of any active transducer layers, whether to obtain frequency

variable apodization or otherwise, Wright is incapable of teaching elements of the claimed invention.

Hossack does not teach any apodization whatsoever, whether by arranging active transducer layers or otherwise. Therefore, Hossack is similarly incapable of teaching elements of the claimed invention.

The present rejection encompasses claims 1-53. As described above, the Applicant respectfully submits neither Wright nor Hossack teach elements of independent claims 1, 7-8, 16-18, 41, 43-44 and 51. Claims 2-6, 9-15, 21-39, 42, 45-50 and 52-53 depend from independent claims 1, 7-8, 16-18, 41, 43-44 and 51. Consequently, the Applicant respectfully submits that the present claims should be allowable.

The Applicant next turns to the rejection of claims 7-8 under 35 U.S.C. § 112, ¶ 2. Claims 7 and 8 have been amended to better define the terms used in equations of the respective claims. Thus, the Applicant respectfully submits that the present claims should be allowable.

Therefore, the Applicant respectfully submits that the claims of the present application should be allowable over the prior art.

CONCLUSION

The Applicant respectfully submits that all claims of the present invention should be in condition for allowance. If the Examiner has any questions or the Applicant can be of any assistance, the Examiner is invited and encouraged to contact the Applicant at the number below.

The Commissioner is authorized to charge any necessary fees or credit any overpayment to the Deposit Account of GTC, Account No. 07-0845.

Respectfully submitted,

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